Sonnengarten - Urban Light Installation with Human-Plant Interaction

Till Fastnacht

Bauhaus-Universität Weimar, Fac. of Media, 99423 Weimar, DE
t.fastnacht@gmail.com

Abraham Ornelas Aispuro

Johannes Marschall

Bauhaus-Universität Weimar, Fac. of Architecture,
99423 Weimar, DE
carlos_aoa@hotmail.com
johannes.marschall@gmx.de

Patrick Tobias Fischer

Bauhaus-Universität Weimar, Fac. of Media, 99423 Weimar, DE
patrick.tobias.fischer@uni-weimar.de

Sabine Zierold

Bauhaus-Universität Weimar, Fac. of Architecture,
99423 Weimar, DE
sabine.zierold@uni-weimar.de

Eva Hornecker

Bauhaus-Universität Weimar, Fac. of Media, 99423 Weimar, DE
eva.hornecker@uni-weimar.de

Abstract
We present a media art installation based on Human-Plant Interaction, which aimed to increase people's awareness of nature via a light-based reaction to touching the plants. We describe the setup and conceptual design and discuss how such an interactive installation might affect usage and overall attractiveness for a central urban place.

Author Keywords
Plant; light, spatial; interface;

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous;

Introduction
Sonnengarten is a light installation with human-plant interaction developed for the light and science festival *CityVisions* which took place for four days in October 2015 in Jena (Germany). The project was an interdisciplinary collaboration between MediaArchitecture and Human-Computer Interaction. The installation was located in the courtyard of a modern-architecture building from concrete and steel. The courtyard serves as a place to linger as well as a throughway to other roads and plazas. Two main ideas motivated the project. One was to raise visitor's awareness of nature via Human-
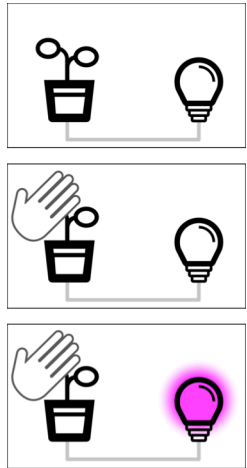
Figure 1: Overview of Human-Plant Interaction. When touching one of the interactive plants on the outside of the frame, the colored light emanated from underneath of the touched plant changes.
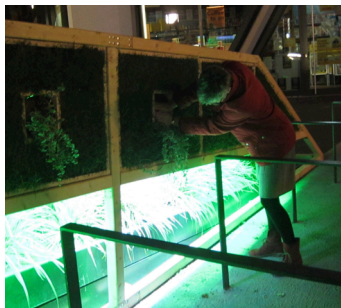

Figure 2: Woman exploring the light reactions.

Plant Interaction, creating a symbolic communication channel between nature and user. Furthermore, the installation was to increase the overall attractiveness of the location and to entice people to stay for longer. The site owners also requested to make the courtyard more visible in order to highlight its function as a passage way between two destinations in the city.

Description of the Installation

Using existing structures in the courtyard, the installation consisted of two separate parts. This created different vistas depending on how visitors passed through the yard. Wooden boxes were built that extended existing architectural elements (air shafts for the underground parking), with outer wall panels covered with grass and 'interactive' plants in the middle of each panel (see figure 2, 3, 4). Between the ground part and the new extension an open gap space remained. Inside this gap space, lights were distributed so that each interactive plant had a corresponding light. Deploying several interactive plants at different heights ensured that the installation could act as a multi-user interface, in order to increase the chance of shared encounters.

Conceptual idea / Interaction Design
Interaction with plants was chosen in order to raise the awareness of nature and emphasise the impact of humanity on the environment. When touching a plant, the corresponding light changed (see figure 1). In general, it is not possible to see plants react to environmental influences in everyday life because of their slow but steady movements. The visual light reaction to touching a plant was to provide a symbolic possibility for the plants to communicate with the person interacting and to highlight how a simple touch affects it.

Figure 3: Courtyard setup, with visitors exploring the installation and several observers. The second structure is visible at the back behind the other structure.

Many art installations share the conceptual approach of providing a human-readable reaction to interacting with a plant. Yet most of these utilize a sound reaction, e.g. *Akousmaflore* by the artist duo *Scenocosme* [1] or *Pieces for Plants* by M. Masaoka [2]. *Sonnengarten* however introduced a different mode of communication or feedback to interaction (light). To the best of our knowledge, a light reaction has not yet been used for an urban spatial interface with plant interaction.

Initially, we planned to illuminate the whole gap space of the installation with white light. On interacting, the light next to the corresponding plant should fade out. This was to illustrate the harmful influence of people on nature by symbolically taking away plants' energy of life – light. This was reconsidered as it was likely to reduce visitor's willingness to interact, as they would receive a negative feedback to interacting. Thus we

Day of Festival	Duration of interaction in seconds
Thursday	3
Friday	3
Saturday	3
Sunday	5

Table 1: Average duration of interaction with the plants. On Sunday, when the light reaction was extended also the interaction duration increased.
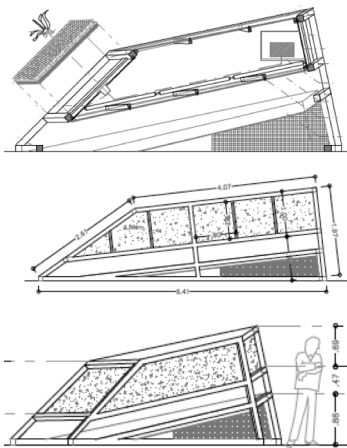

Figure 4a-c. Structure of the installation (technical drawings)

adapted the design for a more colorful, inviting alternative that would illuminate the entire installation. On interacting, the color of the lamp belonging to the plant brightened up until it was white. On release, it changed back to the default hue. This interaction concept points out the overall influence of human interaction with nature in a symbolic way and provides the plant with an allegorical possibility to communicate.

The illumination colors of the installation were changed every evening. After the first evening, we changed them as we had found that two other installations in the same courtyard overshadowed the Sonnengarten. These were placed on opposite corners of the courtyard and grabbed attention, not leaving enough time for people to notice our installation when passing through. At this time, our installation had a default illumination of dimmed white light. With colorful lights on the other evenings, the installation attracted far more attention. On the last evening, the light reaction was adapted to test if we could increase the duration of interaction. The previous one-level light reaction was extended so that on touching a plant, the color changes a second time after a longer contact. From analysis of data logs, we could see that our approach worked. The average touch duration rose from 3s to 5s (see table 1).

Implementation
A main goal of the installation was to recognize when plants were touched and to control the light at this position. During development, different approaches were tried to read plant signals. Working with measuring a plant's reaction to the environment (biofeedback) under instructions of L. Garcia [3] provided us with useful insights into the abstract world of plant-signal response, but turned out to be too complex for simple touch

recognition because every environmental impact on a plant changes the signals (e.g. weather). The advanced capacitive sensing technology of *Swept Frequency Capacitive Sensing,* introduced by M. Sato et al. [4], seemed to provide a solution for explicit touch recognition, and had already been utilized with plants [5]. Further testing revealed that enhanced touch recognition was not necessary for our task, so we eventually used simple capacitive sensing.

The final system worked as follows. As part of the touch recognition circuit, the plant acts as an extended electrode, using the MPR121 sensor connected to an Arduino Uno Rev. 3 (cf. figure 5). On interacting with the plant, a change in state is measured and processed. A laptop receives the Arduino signals whether a plant is touched or released and controls the lights. Status changes are visualized in a shifting of light color with lamps using DMX attributes that enable addressing specific light devices and their attributes (cf. figure 4).

Influencing Perceptions of the Courtyard
The installation *Sonnengarten* aimed to attract people to the courtyard and to increase its general attractiveness as well as the duration of stay in the courtyard. In addition, passers-by from the outside should be attracted to enter the area. By using organic building materials (wood, grass, plants) which contrast the originally dominating materials of concrete and steel in the courtyard, in combination with the colorful illumination, we aimed to create a different mood and perceptual quality that invites and attracts people. To increase the duration of stay, the interaction was designed for shared encounters to occur. Having multiple interaction zones in one area enabled strangers to explore the installation simultaneously, creating a chance for chit-

Figure 5: Overview of the implementation. Touch recognition via capacitive sensing is processed on a laptop in order to control the lights.

chat. The plants were furthermore deployed at different heights around the structure to provide variation in the interaction and to enhance exploration.

Sonnengarten offered diverse possibilities of exploration influenced by the light reactions of the human-plant interaction and aimed to trigger visitors' curiosity. Besides of direct interaction, observing the light effects triggered by other people can effect the experience of the location. The courtyard's layout further created different spaces where visitors could explore the installation from different angles and see different views.

During the festival we witnessed different approaches to interaction. Some visitors briefly interacted with the plants and continued their way after figuring out what happened. Others stayed considerably longer and tried out different ways of interaction and various positions. Also, the technical implementation attracted considerable interest. It would have been interesting to see how visitors approach and understand the interactive aspect of the installation without any background knowledge. But because of the festival context, this was not fully possible. Information material such as leaflets, web presence and other kinds of announcements, already provided most visitors with some indication of the interactivity of presented exhibits.

Future Work
During the festival various data was gathered for evaluation. Visitors were asked to fill out the AttrakDiff 2 questionnaire [6] and log files were recorded of duration and other details of the plant interaction. Moreover the location was filmed from birds-eye view. From analyzing this data, we hope to find out what influence the installation had on visitors and the place.

References
1. Grégory Lasserre, Anaïs met den Ancxt. 2007. Akousmaflore. Retrieved June 8, 2016 from http://www.scenocosme.com/akousmaflore_en.htm

2. Miya Masaoka. 2002. Pieces for Plants. Retrieved June 8, 2016 from http://www.miyamasaoka.com/interdisciplinary/brainwaves_plants/pieces_for_plants.html

3. Leslie Garcia. Pulsu(m) Plantae. Retrieved June 8, 2016 from http://lessnullvoid.cc/pulsum/

4. Munehiko Sato, Ivan Poupyrev, and Chris Harrison. 2012. Touché: enhancing touch interaction on humans, screens, liquids, and everyday objects. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '12). ACM, New York, NY, USA, 483-492. DOI=http://dx.doi.org/10.1145/2207676.2207743

5. Ivan Poupyrev, Philipp Schoessler, Jonas Loh, and Munehiko Sato. 2012. Botanicus Interacticus: interactive plants technology. In *ACM SIGGRAPH 2012 Emerging Technologies* (SIGGRAPH '12). ACM, New York, NY, USA, Article 4 , 1 pages. DOI=http://dx.doi.org/10.1145/2343456.2343460

6. Mark Hassenzahl, Michael Burmester, and Franz Koller. 2008. Der User Experience (UX) auf der Spur: Zum Einsatz von www.attrakdiff.de. In Brau, H., Diefenbach, S., Hassenzahl, M., Koller, F., Peissner, M. & Röse, K. (Hrsg.): Usability Professionals 2008, 78-82. Stuttgart: German Chapter der Usability Professionals Association.